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APPLICATION OF MODERN POPULATION CENSUS TECHNIQUES IN GHANA

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No.102 APPLICATION OF MODERN POPULATION CENSUS TECHNIQUES IN GHANA

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INTRODUCTION

The 1960 Population Census of Ghana was a clear departure from the customary population counts in Africa. In its objectives, scope, techniques and procedures it can be regarded as a modern Census. In the first place the principles and recommendations of the United Nations and its specialized agencies (like the International Labour Office) were accepted as the basic rules. Modifications were made only in a few cases owing to the need for adaptation to the local, social and physical environment. Moreover, several quite refined techniques concepts and classifications used in statistically well advanced countries were applied for the first time in Africa. The programme of appraisal of the application of these methods is now in progress and only some provisional results will be quoted in this paper.

1. THE 1960 POPULATION CENSUS PROGRAMME

1.1 The Essential Features of the Main Census

The Census was taken in two phases. In the first phase the "main" Census was taken in a relatively short period of March-April 1960. In this, the six essential elements formulated by the United Nations were strictly adhered to. Four of them considered as the most significant departures from the methods and concepts applied in the past in Ghana and in Africa in general, were:

(a) INDIVIDUAL ENUMERATION: Each person was enumerated and recorded on a separate line of a questionnaire containing 11 items relating to demographic, social and economic characteristics of the population. In the past it was customary, particularly in rural areas, to carry out group enumeration by counting the number of persons, of each sex and in broad age groups, living in a given family, house or even entire village. This system allowed only a limited analysis and eliminated the possibility of callbacks and checks.

(b) SIMULTANEITY: This feature was achieved by relating the whole enumeration to Census Midnight 20 March 1960 and by carrying out the entire enumeration within a maximum of six weeks (three quarters of the population were enumerated within the first fortnight). Census Night, 20th March, was given wide publicity several months ahead and the population, especially heads of houses and literate persons, were asked to remember the Census details of persons who slept in the house on Census Night. Also, country wide celebrations were held on that night (drumming, dancing etc) to impress the importance of Census date upon the minds of the population.

(c) UNIVERSALITY: Every person alive at midnight of 20th March ought to have been counted at the place of stay on that night without distinction of race, nationality, sex or age.

(d) DEFINED TERRITORY: In order to ensure comparability with past and future population censuses and above all in order to decrease to the minimum under-count or over-count, a vast geographic operation preceded the Census

enumeration. The whole country was devided into 6,882 Enumeration Areas (E.A's) of varying size and containing an estimated population ranging from about 700 in rural areas of dispersed settlement to about 1,200 in more densely populated urban areas. The boundaries of the E.A's were plotted on maps and described on special forms to help each enumerator to identify exactly the area he was expected to enumerate. The E.A's are used also for the analysis of the Census information and for many planning and research purposes (e.g. sampling designs).

1.2 The Objectives and Design of the P.E.S.

In the second phase, within less than three months after Census date a Post Enumeration 5% Sample Survey (P.E.S.) was conducted with two main objectives:

(a) To evaluate the reliability of the main Census information namely the accuracy of the count and of the content of replies (i.e. coverage and content errors evaluation). The ultimate purposes are to estimate both these errors and above all to study the extent of success of the methods and procedures adopted in 1960 for the improvement of future enquiries.

(b) To enquire into additional topics which could not be included in the main Census questionnaire e.g. migration, household structure, marriage habits and fertility.

To achieve the above objectives two operations were carried out as part of the P.E.S. project and a third one is at present still in progress:

(I) Re-enumeration of all persons in 5% of Census houses on a special household questionnaire, in which 9 were the items repeated from the main Census and 11 additional topics of enquiry. The sample was a two-stage stratified design with the 6,882 E.A's of the Census constituting the "population" from which the first stage units (868 E.A's) were selected. The 6882 E.A's were first stratified according to their urban, semi-urban, sub-urban or rural nature. Out of the first two categories a systematic selection of 1/5, and out of the latter two, 1/10, of the E.A's was made. The second stage units were the houses and compounds listed in the Census: 1 out of 4 houses (and compounds) in the urban and semi-urban and 1 out of 2 houses (and compounds) in the suburban and rural E.A's were selected systematically. The over-all sampling fraction in both cases was 1/20.

(II) Listing of all houses in 344 E.A's (5% of Census E.A's) to find out houses which were omitted (or enumerated twice) during the main Census. In this case a sub-sample of the first stage units mentioned under (I) was selected in a random-systematic manner.

(III) Reconciliation Checks - Comparisons of information recorded under (I) and (II) above with that in the main Census are being carried out in the office and in the field since the P.E.S. enumeration (June 1960). These should form the main part of the evaluation programme.

The P.E.S. although a part of the Census programme was statistically an independent enquiry. No advance information on the number and characteristics of the population to be covered was given to the interviewers. In operation (I) only the list of addresses of sample houses was given to the interviewer with the instruction to enumerate all persons found in these houses. In operation (II) only E.A. maps were provided.

2. EXAMPLES OF CONCEPTS AND TECHNIQUES

2.1 The Basic Approach

Among the various concepts preference was given to those which could be clearly and in an unambiguous manner defined. In particular, concepts defined or described by certain physical facts or events were used in preference to those which, although perhaps more refined or more commonly used at the same time also implied a greater risk of misinterpretation or variable interpretation by different enumerators or respondents. In selecting techniques and methods those in respect of which a better control could be achieved were preferred. In most cases concepts, definitions and methods were pre-tested in the field before a final decision on their application was reached. However, it is not claimed that the Census is free of bias and the programme of evaluation intends to cover the various aspects of Census taking without prejudice.

2.2 De-facto Population Count

The method of strict de-facto population count was used. The principle that only persons alive in the house and in the locality on Census Midnight should be counted received wide publicity. This principle was in contrast to the deeply rooted social feeling of family and kinship solidarity and concept of "home-town" meaning locality of origin of the family. In past population counts in Ghana and in many other African countries the principle of family affiliation appears to have been mainly adhered to. It can now be assumed that this latter method led in many cases to double counts. At the same time it should be pointed out that the undercounts due to omissions and wilful evasions might have been more considerable.

The de-jure or usual residence concept was not adopted in the 1960 Census because it was likely to be confused with the home-town concept, unless strictly related to length of residence. For ease of enumeration this time element was excluded.

It was considered that the de-facto principle is clearer as it is based on the physical fact of presence on Census Night. If strictly adhered to and in normal periods, namely without extraordinary migratory movements, it should approach very nearly the usual residence concept. It was partly because of this that the Census date in Ghana was chosen in the "dry season" when migration of agricultural labour force is considered at its lowest. The de-facto count should give a more accurate count especially in those African societies where husbands and wives live sometimes separately and where their children sometimes stay with the father, and at other times with the mother, or grandmother or uncle etc.

2.3 The Age

(a) THE NOTION OF AGE: In countries where the population is to a considerable extent not provided with birth certificates and where illiteracy is still predominant the notion of age is very vague. Usually the information on age is an estimate of the enumerator or the respondent. Various methods and devices are used to estimate the age of persons and most if not all of them are apt to introduce biases in the age statements. Some of the misstatements which are biased downwards as well as upwards like those caused by the preference of certain digits (0, 5 etc) have been studied by several demographers and methods have been proposed on how to measure and correct them (Whipple, Bachi, Myer and U.N. Secretariat). Others, like those of unmarried women tending to

understate or of young mothers to overstate their age or of older persons to exaggerate their age, are more difficult to correct. There are, also some mis-statements which are less known and take the statistician and demographer by surprize. These are largely connected with the methods adopted for eliciting or estimating the age, e.g. methods which relate age to certain physiological events (teething, puberty, menopause) or personal events (school entrance, marriage) or historical (national and local) events or the facial appearance of the person.

Owing to these difficulties it was customary in past censuses of several countries in Africa and elsewhere not to record the age of a person but, particularly in group enumeration, to count and classify first the population in broad age groups (e.g. children, grown-ups, and elder persons) and subsequently to enter the figures in special columns or cells of the questionnaire. This method had the only advantage of concealing the errors. On the other hand, several disadvantages, mainly that of not allowing for any study of age mis-statements and their correction, were inherent in the system and the data on age as such were of little if any use for demographic analysis.

(b) METHODS OF AGE ESTIMATION IN THE GHANA CENSUS: In the Ghana Census it was decided to make a serious attempt to elicit the age of the population in single years of age as accurately as possible in the given conditions. The results of the First Field Test[1] conducted in the preparatory period of the Census indicated that the notion of age is quite reasonable in certain classes of the population and that the methods tested proved quite helpful.

It was, therefore, decided to spread the notion of age to the entire population. In the Census education campaign through radio, newspapers, talks etc the topic of age was one of the most publicised Census items. In lesson notes to teachers the latter were asked to elicit the age of the school children and by this way also to assist in estimating the age of their parents. Chiefs and elders in rural areas were asked to refresh the memory of their people on national and local events.

In the Enumerator's Manual the methods to be used were exemplified and the following order of preferences was suggested: certificates (of birth, baptism, etc); historical-national events the list of which was given in the same manual; local events; method of relating the age to certain personal or family events (e.g. age of children to that of parents); other methods, like facial appearance.

2.4 Regular School Attendance

For the sake of brevity of the main Census questionnaire items only one question - either on literacy or on the level of education - could be included. The question on literacy, defined conventionally by the knowledge to read and write was excluded because its interpretation was likely to vary considerably. Instead, actual attendance at regular schools, type of school and grade attained were enquired into in order to ascertain the level of education. This method was considered more appropriate despite the fact that it may not cover the whole literate population. Some people may acquire education outside the regular school while others although having attended a primary school might nevertheless not be literate.

The question on literacy was included in the P.E.S. where a higher quality of interview and a more uniform interpretation was expected. Its main aim is to serve as a measure of appraisal of the Census information on school attendance. The results might suggest the extent to which the above assumption was right.

1. B. Gil, 1960 Population Census of Ghana, Report on the First Field Test, Government Statistician's Office, Accra, December 1959.

2.5 Economic Activity in a Reference Period

For the description of the economic characteristics of the population the labour force concept with some modification was adopted. Those who worked during the month preceding the Census date for even one day only or for a few hours daily were regarded as "employed". The essential modication of the concept consisted in the consideration of all "job holders" as employed. This means that even those who did not work in the reference month but had a job from which they were temporarily absent (e.g. farmers in off-season, workers on leave, temporary lay-off and similar categories of workers) were included among the employed category. Adding to the number of these employed persons those who stated to be completely unemployed (but looking for a job) during the reference month we obtain the total economically active population. The interpretation of the data is facilitated by the distribution of the population aged 15 years and over by type of activity, sex and age (Fig. III), and of the employed persons by industry and occupation (Fig. IV). It appears for example, that the labour participation rate of the female population is relatively high, especially in the age groups 40 to 64. At the same time the majority of the female workers are engaged in agriculture - 58% (17% being family workers) and 28% in petty trading which is very often a part-time work only. These are very important points to consider in the analysis of the present economic structure and of the expected changes in a developping economy (e.g. intensification of market economy, industrialisation and general educational and technological advancement).

3. APPRAISAL OF SOME RESULTS

3.1 The evaluation project is, at the time of writing this paper, only in its initial stages as first priority is being given to the processing and publication of the Census information. However, some provisional results of evaluation obtained by rather rudimentary methods and simple counts might be of some interest.

3.2 Summary of Census and P.E.S. Discrepancies

The main part of the content error evaluation consists in a comparison between the information recorded for each single person in the P.E.S. This means that only persons whose names in the main Census could be matched with those in the P.E.S. are included. For reasons of economy a sub-sample of about 7% of the P.E.S. E.A's (0.5% of total population) is being examined intensively.

It was mentioned that the P.E.S. information was intended to give a measure of the main Census errors. It is normally assumed that a sample enquiry with a more qualified field staff is more reliable than a large scale Census. At this stage it cannot be stated to what extent this applies to Ghana, particularly in view of the fact that in certain cases the contrary appears to be true. At present one can only give a provisional measure of the discrepancies between Census and P.E.S. data.

The results of the comparison between Census and P.E.S. replies, person by person and item by item, were classified according to the "severity" of the discrepancy using a somewhat arbitrary classification of four grades: 0, I, II, and III. For example, in the case of age the respective discrepancies were: 0 (no discrepancy), 1 to 4 years, 5 to 9 years, 10 or more years, irrespective of sign (see Table 1).

On the whole, if we consider the largest percentage of identical replies as reflecting the degree of reliability of Census and P.E.S. data, then the most reliable would be the replies on tribe (98% identical), education

(88%) and somewhat less reliable the replies on type of activity (80%) and birthplace (70%). The most affected by discrepancies and consequently the least reliable is age.

With respect to economic activity a discrepancy does not necessarily mean that one of the replies (Census or P.E.S.) is wrong. The difference may be partly due to a true change in activity between the dry season of the main Census and the rainy season of the P.E.S. period. Also a non-response in one of the above enquiries was considered as a severe discrepancy. This latter classification may be correct with respect to the appraisal of the work of the enumerator but not necessarily of the statistical data, if the non-response happened to be proportionately distributed.[1]

In the case of age only a small proportion of grade (I) discrepancy could be due to a true change i.e. to the aging of the population between Census and P.E.S. The rest and largest part of the discrepancy is a definite proof that one, at least, of the replies was wrong. Here again the discrepancies may not affect the statistical data in all respects. For example, in the analysis of the relationship between age and other demographic and economic characteristics, the age distortions may affect the results significantly. On the other hand, in the consideration of the mere age structure their effects may be less apparent (see below).

3.3 Census and P.E.S. Age Comparison

With respect to the age distribution some additional measures have been obtained. A detailed comparison of age statements given in Census with those in P.E.S. has been made in a sub-sample of 52 E.A's for persons aged 15 years and over who could be matched (see Table 2). The discrepancies, as expected increase with advancing age. Also, in younger ages (15-34) the "net" discrepancy gives a higher age in P.E.S. than in Census; the total percentage of those stating a higher age in P.E.S. is larger than the percentage stating a lower age. In the older ages (35+) the "net" discrepancy shows a lower age in P.E.S. On the whole, it appears that the "plus" discrepancies offset the "minus" ones to a large extent. Comparing the percentage age distribution of the matched persons obtained from the main Census with that from the P.E.S. (Table 2, last two columns) one does not find considerable and clear shifts in the distribution. The existing ones, however, should not be minimized and more information has to be gathered for a better appraisal.

The results of comparison of age and birthplace information in Census and P.E.S. may throw some light on the observed percentage age distribution by sex shown in Fig. I. This age structure is partly affected by the peculiar sex and age structure of the immigrants (foreign born) and their descendants born in Ghana (foreign origin born in Ghana). But partly, the age distortions affect also the population of Ghana origin. Abnormally high percentages are found among males in age groups 25-29 and among females in age groups 20-24 and 25-29 (Table 6).

The following are the main possible explanations, listed not necessarily in order of importance:

(a) Age mis-statements, mentioned above.

(b) Mis-statements in origin and birth information. Table 1 shows a discrepancy (Grade III) in respect of country of birth between Census and P.E.S. of 5%. This may not be the exact measure of mis-statements, and should not necessarily be taken as a proof that foreign born or persons of foreign origin born in Ghana stated in the Census that they were born in Ghana or that they were of Ghanaian origin, respectively. But it shows definitely that some mis-statements were made either in Census or in P.E.S.

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1. In fact in the P.E.S. evaluation study of the 1950 Censuses of Population and Housing of the United States, the census "non-reported" figure was distributed among the P.E.S. categories proportionately to the distribution of the weighted P.E.S. sample results.

(c) Emigration of persons of Ghana origin. Their number, sex and age structure are not known. The 1960 Census counted some 25,000 Ghanaians who were born abroad but resided in Ghana at the time of the 1960 Census. The number of Ghanaians who are still abroad is not known; it may not be considerable but on other hand, also not insignificant.

(d) Fluctuations in fertility and mortality in the past.

3.4 Other Measures of Age Accuracy

On the whole the age information obtained in the 1960 Census compares favourably with data of other African and some selected Asian countries. The index measuring the preferences for certain digits (e.g. 0, 5, 8) in age reporting (Myer's Index, Table 4) puts Ghana third in rank among the selected countries. The sex and age ratio scores and the joint index for Ghana total population and particularly for persons of Ghana origin (eliminating influence of immigration on the age of structure) rank fourth with respect to general quality of age data (Table 5). It appears also that by a simple graduation the 5-year age distribution of persons of Ghana origin becomes smoother and approaches the expected one (Table 6). Further and more refined adjustments could be carried out after additional information has been obtained on the causes and extent of mis-statements and distortions.

TABLE 1 - SUMMARY OF DISCREPANCIES BETWEEN CENSUS AND P.E.S. BY ITEM AND GRADE - Percentages

Grade of discrepancy	Age	Birth place	Tribe	Level of education	Type of activity	Definition of discrepancy grades				
						Age difference in years:	Birth place difference between:	Tribe difference between:	Education - difference in attendance of:	Type of activity differences like:
Total	100	100	100	100	100					
0	24	78	92	88	80	No discrepancy between Census and P.E.S.				
I	39	14	1	4	1	1 - 4	Localities	Sub-groups	Grades	Employed Yes/No
II	20	3	2	1		5 - 9	Regions	Groups	Types of school	
III	17	5	5	7	19	10 +	Countries	Major groups	Attended: Yes/No	Econ. act: Yes/No

TABLE 2 - COMPARISON OF CENSUS AND P.E.S. ENTRIES ON AGE - Percentage of persons reporting in P.E.S. an identical, higher, or lower age than in main Census.

Age in census	Total	Identical	P.E.S. higher by ..... years				P.E.S. lower by.....years				Age Distribution of matched persons	
			Total	1	2-4	5 +	Total	1	2-4	5 +	Census	P.E.S.
Total 15 and over	100.0	23.6	36.0	6.8	11.5	17.7	40.4	6.4	13.3	20.7	100.0	100.0
15 - 19	100.0	35.4	44.8	16.1	17.7	11.0	19.8	10.7	9.1	0.0	/ 8.3	/ 8.2
20 - 24	100.0	29.8	42.3	11.4	16.1	14.8	27.9	7.7	15.7	4.5	/ 12.2	/ 12.9
25 - 34	100.0	23.0	40.3	7.4	13.3	19.6	36.7	7.4	17.4	11.9	27.1	27.4
35 - 44	100.0	22.7	31.4	3.6	8.4	19.4	45.9	5.8	13.7	26.4	20.3	19.7
45 - 54	100.0	22.0	32.3	5.1	7.2	20.0	45.7	4.0	11.6	30.1	14.5	13.8
55 - 64	100.0	19.1	33.7	3.6	11.6	18.5	47.2	5.4	9.3	32.5	8.8	9.3
65+	100.0	15.0	25.1	3.6	7.8	13.7	59.9	3.9	7.2	48.8	8.8	8.4

1. In this first and incomplete matching the percentage age distribution of matched persons is different from the one obtained from the tabulation of the total population in Census or in the 5% P.E.S. sample. Particularly small appear to be the percentages in ages 15-24. The results of this table might somewhat change with more complete matching.

TABLE 3 - INDICES OF PREFERENCES (+) OR DISLIKES (-) FOR VARIOUS DIGITS IN AGE REPORTING, GHANA POPULATION CENSUS 1960[1]

	Sex	0	1	2	3	4	5	6	7	8	9	Index (total)
Percent of total "blended" population	M	20.8	6.3	10.0	6.5	7.9	13.6	9.4	6.9	11.0	7.6	
	F	21.8	6.4	10.0	6.3	8.0	13.0	4.4	6.3	11.4	7.4	
Deviation (±) from the expected 10%	M	+10.8	-3.7	-	-3.5	-2.1	+3.6	-0.6	-3.1	+1.0	-2.4	30.8
	F	+11.8	-3.6	-	-3.7	-2.0	-3.0	-0.6	-3.7	-1.4	+2.6	32.4

1. Calculated according to Myer's formula shown in U.N. Population Studies No. 23 (ST/SOA/Series A) for the 10% sample data given in the Advance report of Volumes III and IV, Census Office, Accra, 1962.

TABLE 4 - INDEX OF DIGIT PREFERENCES (AND DISLIKES) IN AGE REPORTING IN CENSUSES OF SELECTED COUNTRIES[1]

Sex	Ghana	Portuguese Guinea	Union of South Africa (total population)	Algeria Moslems	Egypt	Cyprus	Turkey	Ceylon
	1960	1950	1946	1948	1947	1946	1945	1946
Males	30.8	52.1	33.2	23.3	91.7	28.9	39.8	26.4
Females	32.4	39.8	32.3	33.9	101.0	43.2	81.1	29.5

1. Calculated according to Myer's formula for data given in the U.N. Demographic Years Book (1955). This index may range between "0" (no preferences or dislikes for special digits) and 180, the theoretical maximum. Divided by "2" the index shows the percentage of persons reporting ages with inaccurate terminal digits (see R. Bachi, Measurement of the tendency to round off age returns, XXVIII session of the I.S.I. Rome 1954).

TABLE 5 - COMPOSITE INDEX OF INACCURACY OF AGE AND SEX DATA IN CENSUSES OF SELECTED COUNTRIES[1]

Ratio score	Ghana 1960		Portuguese	Union of South Africa (total population)	Algeria Moslems	Egypt	Cyprus	Turkey	Ceylon
	Total	Ghana origin only	1950	1946	1948	1947	1946	1945	1946
Sex	8.2	7.3	16.3	8.6	6.3	7.1	3.4	12.1	9.6
Age-males	11.6	9.6	12.3	5.9	6.8	24.3	4.4	13.6	12.2
-females	16.0	12.2	18.5	6.9	6.6	28.3	5.1	30.6	11.3
Joint score (weighted)	52.2	43.7	79.7	38.6	32.3	73.9	19.7	80.5	52.3

1. Calculated according to the United Nations Secretariat method explained in U.N. Population Studies No. 23.

TABLE 6 - PERSONS OF GHANA ORIGIN BORN IN GHANA BY SEX AND AGE
Observed and graduated five-year percentage distribution[1]

	Sex	All Ages	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 and over
Observed	M	100.0	19.7	16.0	11.2	8.4	7.7	7.6	6.6	5.2	4.5	3.4	2.8	1.7	1.9	3.3
	F	100.0	19.7	15.3	9.9	7.9	9.4	9.0	7.2	5.2	4.4	2.9	2.6	1.6	1.7	3.2
Graduated	M	100.0	18.0	15.5	12.0	9.3	8.0	7.3	6.4	5.4	4.5	3.6	2.7	2.1	1.7	3.5
	F	100.0	17.7	14.9	11.4	9.3	8.8	8.3	7.1	5.6	4.3	3.3	2.5	1.8	1.6	3.4

1. Calculated according to a modified form of the formula quoted in Population Studies, No. 23. The modified formula uses three 5-year age groups, instead of five, in the following form: $\frac{5}{24}a + \frac{1}{2}b + \frac{5}{24}c$.

FIG. 1 - POPULATION BY SEX, AGE AND ORIGIN

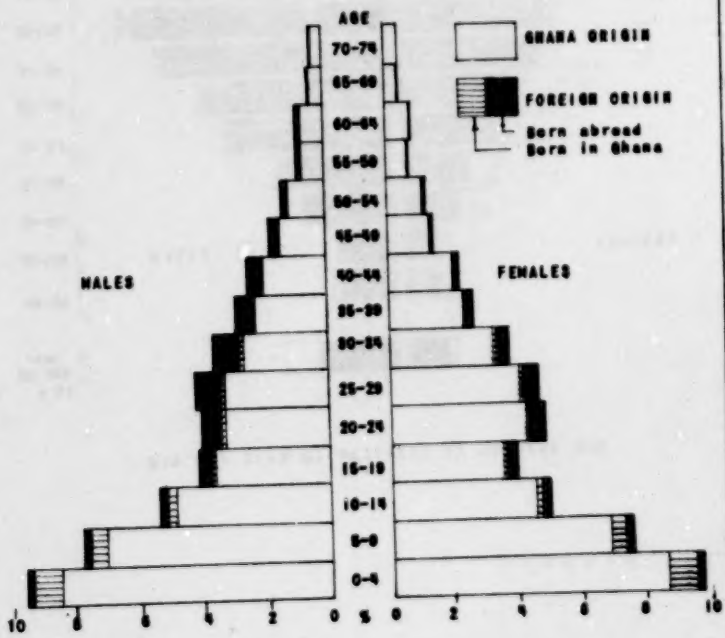


FIG. 2 - SCHOOL ATTENDANCE BY SEX AND AGE

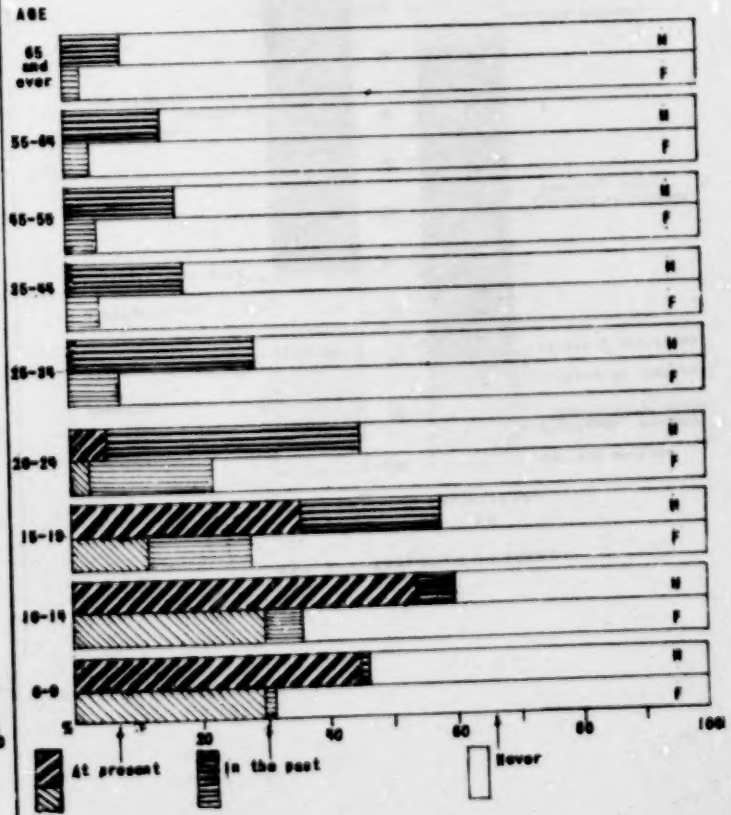


FIG. 2 - TYPE OF ACTIVITY BY SEX AND AGE

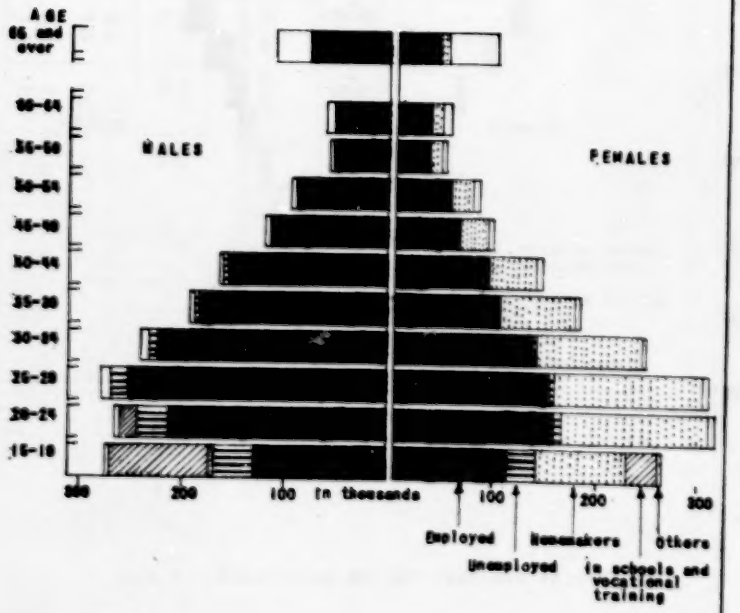
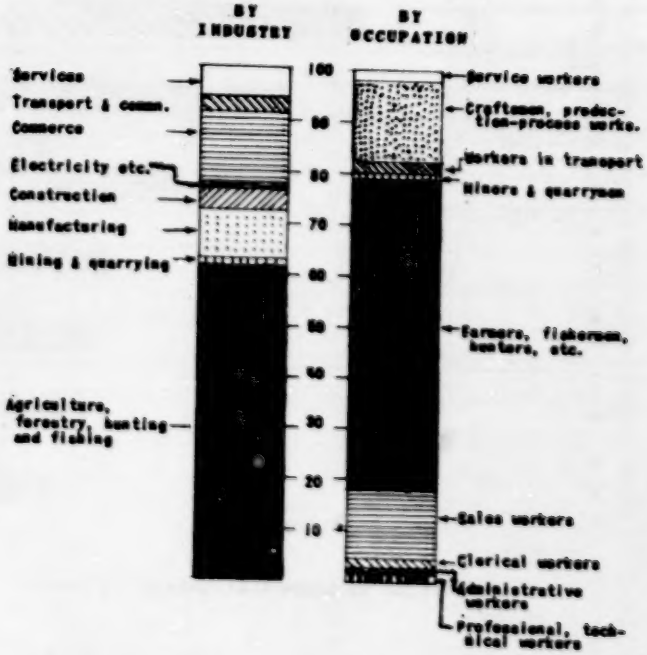


FIG. 1 - EMPLOYED PERSONS



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